CALIFORNIA DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
GEOTECHNICAL SERVICES

CODE OF SAFE DRILLING PRACTICES

September 2015

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Introduction

The intent of this Code of Safe Drilling Practices (COSDP) is to document and promote safe work practices for geotechnical drilling. The COSDP is written to the Geoprofessional, Foundation Drillers, and visitors to the drilling work site. It is expected that persons present at the drilling site have a working knowledge of the COSDP as well as the contents of the approved Drilling Plan and applicable references, such as Chapter 8 of the Maintenance Manual, prior to commencing the drilling operation.

The COSDP documents general safe practices for persons at the work site, such as roles and responsibilities for the Geoprofessional and Foundation Drillers, requirements for safety meetings, and drilling-specific considerations. It is not an equipment operations manual; those are specific to the Foundation Driller and are documented in the Drilling Services Manual.

It is expected that this COSDP be available to all persons at the work site, along with the approved Site Safety Plan and applicable references, such as Safety Data Sheets (SDS) (formally MSDS) and the Maintenance Manual, Chapter 8. You are responsible to have these documents with you.

This Code of Safe Drilling Practices should be updated as needed to comply with the Caltrans Safety Manual and improved safety practices. The Chief, Office of Geotechnical Support, is responsible to maintain a current COSDP.

Primary references for this COSDP are:

- Caltrans Safety Manual
- Caltrans Maintenance Manual, Chapter 8
- Cal/OSHA
- Geotechnical Investigations

A complete list of references is located at the end of this document.

Prequalification for Drilling

Prior to working or visiting an active drill site, staff must be trained in:

- Standard First Aid (certified)
- CPR (certified)
- Heat Illness and Prevention (every 2 years)
- Caltrans Maintenance Manual, Chapter 8 (every 2 years)
- Fire Extinguisher Usage (every 2 years)

Roles and Responsibilities

All Geotechnical Services staff, and any temporary or part-time staff, are responsible for promoting a safe work environment. Per the Caltrans Safety Manual, an employee must…"*do everything reasonably necessary to protect his/her own health and safety and that of others by complying with all occupational health and safety policies, procedures, work*

practices, laws, rules, or regulations to ensure safety and security for all employees, including persons with disabilities."

Geoprofessional

The Caltrans Safety Manual, Sec 1.07, requires that "*management must designate a responsible person in charge whenever two or more employees are assigned to work together*." For geotechnical drilling, the "*Responsible Person in Charge*" is the Geoprofessional present at the drill site.

As the *Responsible Person in Charge*, the Geoprofessional is responsible to:

- Implement the approved Site Safety Plan, which must include a working knowledge of utility locations, physical hazards, and permitting specifics.
- Communicate to the Foundation Driller Lead Worker the operational needs of the drilling program, such as the borehole location, total depth, sampling plan, etc.
- Coordinate with the Foundation Driller Lead Worker to ensure safe work practices are followed at the work site.
- Document information relating to safety issues or accidents that occur at the work site.
- Coordinate with Maintenance, the District Hazardous Waste Coordinator, CHP, or any other entity as required for the drilling work, and to resolve any problem that occurs during the field operation.
- Cease all field work if unsafe conditions (fog, wild fires, rain, lightning, etc.) exist or develop at the work site.

Foundation Driller Lead Worker

The Foundation Driller Lead Worker is person in charge of the drilling equipment, foundation drillers and drilling operations, and is responsible to:

- Communicate and coordinate with the geoprofessional to ensure safe work practices are followed at the work site.
- Check the Site Safety Plan for underground and overhead utility clearances, and verify field utility markings.
- Cease all field work if unsafe conditions (fog, wild fires, rain, lightning, etc.) exist or develop at the work site.
- Act as the "*Responsible Person in Charge*" when the Geoprofessional is not present or unable to perform duties.

Foundation Driller

The Foundation Driller is responsible to:

- Operate equipment in accordance with Drilling Services Equipment Operations Manual.
- Notify the Foundation Driller Lead Worker and Geoprofessional of unsafe conditions at the work site.
- Act as the Foundation Driller Lead Worker when the Foundation Driller Lead Worker is not present.

Safety Meetings

On-site tailgate safety meetings must be held at the start of each new job and documented on the Safety Meeting Report Form (PM-S-0110) (triplicate format), supplied by the Foundation Driller. Tailgate Safety Meetings must also occur at intervals not to exceed 10 working days, as required by the Caltrans Safety Manual, and when changing the work zone, the lane closure, or when new personnel arrive on site.

The meeting is conducted and documented jointly by the Geoprofessional and Foundation Driller Lead Worker on the Safety Meeting Report Form (PM-S-0110).

Foundation Driller Lead Worker must discuss and document:

- Equipment safety (kill switch location, spill mitigation, fire extinguisher, etc.)
- Equipment setup considering site constraints
- Safety Data Sheets (SDS) (formally MSDS)

Geoprofessional must discuss and document:

- Site Safety Plan (underground and overhead utilities, hospital location, emergency communication protocol, traffic handling plan, etc.)

The Foundation Driller Lead Worker must retain the top form, sign as the "First-line Supervisor", and submit it to his supervisor by the end of the work week. The Drilling Services Branch Chief must sign as the "Second-line Supervisor."

The Geoprofessional must be given an unsigned copy of the Safety Meeting Report.

Personal Protective Equipment (PPE)

All personnel working on drill sites must wear proper safety clothing as required by Chapter 12 of the Safety Manual. Furthermore, personnel are prohibited from wearing loose clothing, jewelry, or long, free hanging hair that can become entangled in machinery.

Always Required:	Hard Hat Eye Protection Ear Protection Steel-toed Work Boots Gloves Class III high-visibility garments
Night Work:	As above plus Class III pants
Barge, Railroad, Limited Access:	Per Site Safety Plan
Breathing Protection (Respirator):	Per Site Safety Plan and Safety Manual, Chapter 15

First Aid Kits

Comply with Maintenance Manual, Chapter 8.08.

All drilling equipment, including truck-mounted drill rigs, tenders, and the barge, must have a 16-Unit first aid kit. The Foundation Driller Lead Worker must inspect and resupply the kit as required to keep the kit fully stocked.

Lane Closure Safety

Traffic closures are installed either by Maintenance or contractors. Geotechnical Services staff are prohibited from installing, maintaining (including flagging), and/or removing lane/shoulder closures.

Neither the Geoprofessional nor the Foundation Driller is trained on the proper installation of traffic closures (Maintenance Manual Chapter 8). Therefore, the Geoprofessional should coordinate the inspection of the traffic closure with Maintenance prior to entering the closure.

Night Work Safety

Illumination must comply with Cal/OSHA Subchapter 4, Construction Safety Orders, Article 3, Section 1523.

Rope Access Work

Foundation Drillers and Geoprofessionals must be pre-qualified by a GS *Certified Climbing Instructor* on a job by job basis.

General Safety Practices for Drilling

- Preferably, the geotechnical workstation should be set up outside of the immediate drilling work area a distance of at least 1.5 times the mast height away from the drill.
- Employees must know their individual duties so that work can progress smoothly, efficiently, and safely. Discuss roles and expectations (e.g. sampler handling) during the tailgate safety meeting.
- Use all required safety equipment. (see PPE section and the Site Safety Plan)
- Stay alert to drill rig malfunction, falling objects and traffic hazards.
- Know where the “kill” switch is located on the drill rig.
- Be familiar with any equipment specific hazards.
- Use the buddy system as appropriate

Encountering Unexpected Hazardous Materials

If potentially hazardous subsurface materials are encountered shut down the drilling operation and leave the equipment as-is while doing as follows.

- The Foundation Driller Lead Worker must contact his supervisor to notify him that the drilling operation has ceased.

- The Geoprofessional must notify his supervisor and then contact the District employee who signed the *Site Assessment Questionnaire* for the project.
- The Geoprofessional and/or Foundation Driller Lead Worker must secure the work site and provide for public safety during the suspension of drilling operations.

Drilling work may recommence only after the District, Geoprofessional, and Foundation Driller Lead Worker agree to do so.

Inclement Weather

Safety hazards from weather may include low visibility for approaching traffic, inability to safely operate drilling equipment, potential electrocution from lightning, etc. Drilling work must cease if weather conditions create, or are anticipated to create, unsafe working conditions.

Heat Illness Prevention

Refer to Caltrans Safety Manual, Chapter 23.

Fall Protection

No person shall work 7 feet or more above the ground or ascend or descend the mast unless wearing an approved safety harness that is hooked onto a climbing safeguard device. Refer and comply with Caltrans Safety Manual, Section 12.16 "*Fall Protection*."

Chemical and Material Safety

Proper handling of materials is documented in the SDS (Safety Data Sheets) and must be discussed during the tailgate safety meeting.

Housekeeping

The work area must be kept orderly and free of obstructions such as materials and tools, and substances such as debris, grease, ice, and mud, in order to prevent fall-related injury.

- Drill rod, casing, augers and similar tools should be stacked on racks when not in use.
- Trash should be placed in bags and stored away from the immediate work area.
- Boreholes must be adequately covered or otherwise protected.
- Use approved cleaning solvents instead of flammable liquids as cleaning agents.
- Never use compressed air for the purpose of cleaning clothes.

Electrocution

The most frequent cause of job-related death in the drilling industry is electrocution caused by contact of the drill rig with overhead power lines.

- Whenever possible, locate borings to avoid any possibility of contact with power lines. If drilling near power lines is unavoidable, maintain at least 15 feet of clearance between the power lines and the mast of the drill rig. Higher voltage lines require additional clearance, according to the following table:

MINIMUM CLEARANCE DISTANCES
(**Modified From:** OSHA 1612.1, Power Line Safety (up to 350 kV) - Equipment Operations)

Voltage (nominal, kV, alternating current)	Minimum Horizontal clearance distance* (feet)
up to 175	15
over 175 to 350	20
over 350 to 550	27
over 550 to 1,000	45
over 1,000	*

Note: The value that follows "to" is up to and includes that value. For example, over 175 to 350 means up to and including 350kV.
* as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution.

- When drilling with wire line systems locate the drill rig such that a broken line cannot encroach upon the Minimum Required Clearance in the table above. If this is not possible contact the Power Company to determine if the line can be shut down or further protected during drilling.
- Use a spotter when raising the mast near power lines.
- If contact between the rig and power lines occurs:
    - Assume the entire rig to be electrified. Do not attempt to enter or exit the driver's cabinet, leave the rig, or touch any part of it. Although people in the rig may not be affected, anybody touching the rig while in contact with the ground is in danger of being electrocuted.
    - Call the power company and the local fire rescue squad immediately for assistance.
    - Do not attempt to rescue your coworkers.

Safe Use of Hand Tools

Refer to Cal/OSHA, "*A Guide to Selecting Non-Powered Hand Tools.*"

Proper Lifting

Refer to Cal/OSHA, "*Lifting Safer*" and "*Ergonomic Guidelines for Manual Material Handling*".

Do not lift objects or materials that weigh more than 50 lbs without assistance.

Fire Safety

Personnel must be alert to fire hazards and take appropriate actions to prevent fires, including:

- In off-road areas, the area around the drill rig must be sufficiently cleared of dry grass and other combustibles to minimize the fire hazard.
- Portable fuel (gasoline and diesel) cans must be a Type II Safety Can, FM Approved, UL / ULC Listed, and OSHA/NFPA/CARB Compliant.

- Smoking is prohibited within 25 feet of equipment and employees.
- Funnels and pour spouts must be used to avoid spilling.
- Do not refuel gasoline and diesel engines while in operation.
- A suitable (multi-purpose Class ABC) fire extinguisher must be on hand.
- All members of the drill crew (Foundation Drillers and Geoprofessionals) must receive annual training on the general principals of fire extinguisher usage and the hazards involved with incipient stage firefighting.

References

1. Caltrans Safety and Health Manual
2. Geotechnical Manual
    a. Geotechnical Drilling Module
    b. Geotechnical Investigations Module
3. Caltrans Maintenance Manual, Chapter 8
4. METS/GS Directive 02, Expectations for Employees
5. California Department of Industrial Relations, Cal/OSHA